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ABSTRACT

This paper presents a conceptual model for the purpose of specifying major educational components and their relationship. The initial stage of building this theoretical framework for education includes the clarification of three terms: curriculum, instruction, and learning outcomes. The next section deals with constructs embodied by each of the above components, the nature of constructs, general types of validation, and the importance of one of these types, namely, construct validity. Construct validity is explicated in the context of one educational component: the achieved learning outcomes. Suggestions are given for the investigation of construct validity for other educational components. The need for clarification of educational components for the purpose of theory building in curriculum and instruction is stressed. Once clarified, empirical research can lead to a theoretical framework identifying the relationships between various constructs embodied by each of the components. A 43-item bibliography is included. (Author/MJM)

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EDUCATION: ITS COMPONENTS AND CONSTRUCTS*

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In their classic paper on construct validity, Cronbach and Meehl (1955) pointed out that the development of a "nomological network" or theoretical framework describing the lawful relationships between constructs is crucial when research is conducted in psychology. Their point is certainly applicable to education. There is need for empirically based explanatory theory describing the relationship between classes of educational constructs (Northrup, 1959; Homans, 1950; Beauchamp, 1961).

This paper presents a conceptual model for the purpose of specifying major educational components and their relationships. Since these components each represent a class of constructs, the empirical determination of relationships between components is shown to depend, in part, on the construct validity of measures. Multiple methods of assessment are suggested as an approach to the validation problem inherent with any objective indicator of educational constructs.

Components of Education and Their Relationships

The initial stage of building a theoretical framework for education includes the fundamental problem of clarifying terms. Among the educational components for which clarification is needed are curriculum, instruction, and learning outcomes.

Defining Curriculum

Johnson (1967) recognized that the major problem plaguing the field of curriculum and instruction was one of definition of terms. Definitions of curriculum vary from writer to writer, although most definitions can be categorized into one of several predominant types. Although Johnson is not explicit about these types, one can infer from his description of definitions of curriculum that the following parameters determine the type of definition: (a) process- versus product-orientation, (b) temporal relationship of curriculum to instruction, and (c) programmatic versus descriptive import.

Process versus product. The process-product distinction pertains to whether curriculum refers to the events or results of instruction. The "process" view is exemplified by definitions of curriculum in terms of "learning activities" (Alberty and Alberty, 1962) or "all of the experiences of children for which the school accepts responsibility" (Ragan, 1966, p. 4). Definitions of curriculum in terms of "intended learnings" (Goodlad and Richter, 1966) or "whatever a child learns under the guidance and direction of the school" (Wagner, 1958, p. 328) are examples of product-oriented definitions.

Temporal relationships. The temporal relationship between curriculum and instruction describes the curriculum as prior to, concurrent with, or a report of instruction. Definitions such as " ... the design of a social group for the educational experiences of their children in school" (Beauchamp, 1964, p. 15) or " ... those things we wish children to learn" (Saylor and Alexander, 1966, p. 3) are examples of definitions that imply curriculum to be anticipatory of instruction, i.e., prior to

instruction. On the other hand, definitions such as " ... the means of instruction ... " (Krug, 1957, p. 3) or " ... what a teacher uses when he teaches children" (Wilhelms, 1967), suggest that curriculum is a part of instruction. Definitions such as "whatever ... a child learns under the guidance and direction of the school ... " (Wagner, 1958, p. 328) imply that curriculum is a report of what was learned.

Descriptive versus programmatic. Some definitions promote a particular doctrine and are thus programmatic. Phrases such as "experiences ... having a maximum of lifelikeness for the learner" (Rugg, 1926, p. 18) and " ... set up in the school for the purpose of disciplining children and youth in group ways of thinking" (Smith, Stanley, and Shores, 1957, p. 3) are highly programmatic. Others, such as that of Goodlad and Richter cited above make no statement prescribing the nature or content of the curriculum and are, therefore, non-programmatic or descriptive. Programmatic definitions take a position about what the curriculum should be, whereas non-programmatic definitions describe what the curriculum is.

A proposed type of definition. For the purposes of explanatory theory and basic research a definition of curriculum is preferred that (a) is product-oriented, (b) places curriculum prior to instruction, and (c) is descriptive. This preference is justified by considering (a) the distinction between curriculum and instruction, (b) the role of curriculum with respect to instruction, and (c) the state of the field of curriculum and instruction.

Johnson (1967) pointed out that definitions involving experience rather than learning outcomes cloud the distinction between curriculum and instruction. Process definitions involve interactions since no experience

or activity can occur without an interaction between the individual and his environment. Consideration of interactions, however, is more characteristic of instructional than curricular study.

The second parameter of definitions, namely, the temporal relationship between curriculum and instruction, is clarified when one considers the role of curriculum with respect to instruction. At least part of the curriculum's role is to guide instruction. In order to serve this function, it must be formulated prior to instruction. That is, the curriculum "must be viewed as anticipatory, not reportorial" (Johnson, 1967, p. 130).

The last aspect mentioned above, that curriculum definitions should be descriptive rather than programmatic, is especially important when one considers the state of the field of curriculum. Very little research has been done toward improving our understanding of the phenomena with which educationists are dealing. Educationists, instead, have been more concerned with the pragmatic problem of improving education (Lazarsfeld and Sieber, 1964). Not all educationists should be involved in basic research; but neither should all educationists be directly involved in either the practice or the improvement of education. Some work is needed in basic theoretical research that would lead eventually to a better understanding of the process of education. For the purpose of developing empirically based explanatory theory, therefore, a definition that seeks to describe rather than improve curriculum is needed.

Definitions of curriculum that are anticipatory, product-oriented, and non-programmatic have been found in the literature for the past forty

years. Melvin (1931) discussed the confusion between the fields of "curriculum and method." He emphasized that curriculum should be defined as desired learnings (1931, p. 730). "In a theoretical sense the curriculum should list those learnings independent of the method of the teacher who is to help the pupil attain them" (1931, p. 731). As indicated above, Johnson (1967) also distinguished between curriculum and instruction. He defined curriculum as "a structured series of intended learning outcomes" (1967, p. 130), implying that curriculum is anticipatory to, and distinguished from, the means used to achieve the outcomes. The latter he viewed as the domain of instruction, which involves the means used to convert intended outcomes into achieved learning outcomes. He regarded this distinction between curriculum and instruction to be crucial in research.

Several other writers in the field are in general agreement with Johnson's and Melvin's conception of curriculum. Goodlad and Richter (1966, p. 11-12) defined curriculum as " ... a set of intended learnings." Gagné's definition of curriculum as " ... a sequence of content units ... " (1967, p. 22) with content defined as "descriptions of the expected capabilities of students in specified domains of human activity" (1967, p. 21) is similar to Johnson's definition. Macdonald defined curriculum as the system of "planned actions for instruction," and instruction as "the system for putting the plan into action" (1965, p. 5). Macdonald, therefore, also recognized the need to distinguish plans from actual experiences, but failed to distinguish the curriculum from the instructional plan.

Conceptions of curriculum similar to Johnson's definition can be found in both experimental and descriptive studies. In an experimental study Hutchinson (1963) attempted to determine how learning and thinking processes are affected by different teaching techniques when subject matter is kept constant. Various aspects of the teaching process have been studied independently of the subject matter taught by researchers analyzing classroom discourse (see, for example, Bellack and Davitz, 1968; Amidon and Flanders, 1963; Smith and Meux, 1968; Withall, 1949). These studies imply that by conceptually separating subject matter from teaching methods, a more sophisticated approach to curricular and instructional research results.

Relationship between curriculum, instruction, and achieved learning outcomes. By accepting Johnson's definition of curriculum as a "structured series of intended learning outcomes," one can conceive of the relationship between curriculum, instruction, and achieved learning outcomes as depicted in Figure 1.

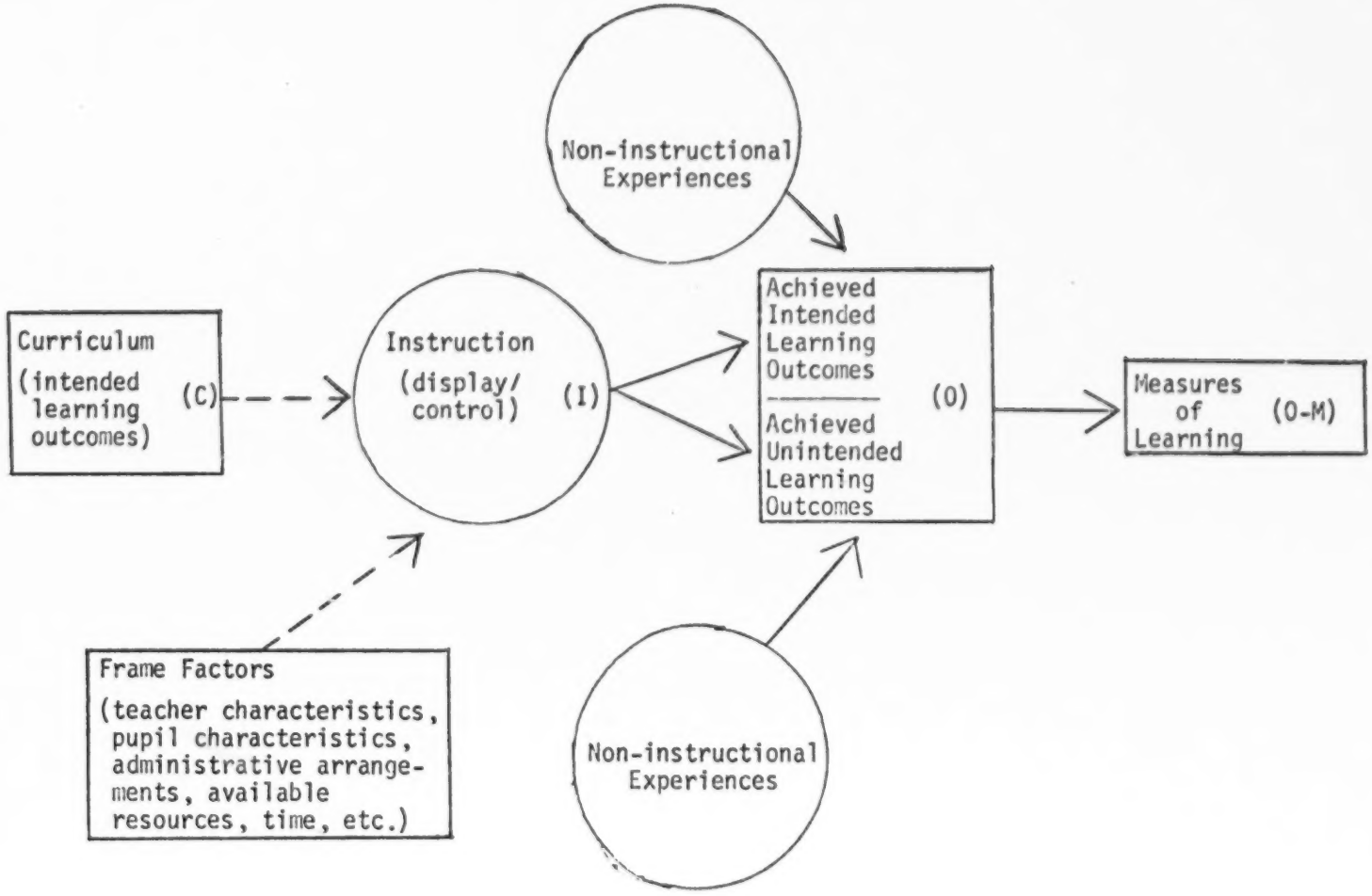


Figure 1. A Model of the Educative Process Showing the Relationship Between Important Educational Components.

Curriculum is shown in Figure 1 to anticipate instruction; it represents the intended learnings without specifying the instructional means of attaining them (Johnson, 1967). Both curriculum (C) and numerous administrative factors ("frame factors") act as inputs to or influences on the instruction (I). This influence is symbolized by a dotted line. Instruction, on the other hand, contributes to the production of the achieved learning outcomes (O). This process of production is symbolized by a solid line.

Instruction

Instruction is composed of the means by which the intended learning outcomes are achieved. Since it is guided by the curriculum, instruction is an intentional activity (Johnson, 1969).

Gagné (1965) specified eight functions of instruction: (1) presenting the stimulus, (2) directing attention and learner activity, (3) providing a model for terminal performance, (4) furnishing external prompts, (5) guiding the direction of thinking, (6) inducing transfer of knowledge, (7) assessing learning attainments, and (8) providing feedback. Functions one and three can be summarized as the "display" functions: they provide the stimulus component of instruction. Functions two, four, five, six, seven, and eight, on the other hand, can be summarized as the "control" functions: they provide the shaping-of-response component of instruction. For the purpose of this study variables related to one or more of the two instructional functions, i.e., display and control, are considered instructional variables.

Achieved Learning Outcomes

According to Figure 1, the purpose of instruction is to enable pupils to achieve the intended learning outcomes. That is, the purpose of instruction is to promote learning, learning occurring when a particular pupil's capability of behaving in a particular situation changes (Gagné, 1965).

Learning distinguished from measures of learning. Learning and behavior, although often related, are not the same (Smith, 1961). Learning can occur without a measurable change in gross behavior, although behavioral indicators of learning are needed to certify its occurrence. Measures of learning can only be considered indices of learning and not the learning itself. This distinction is discussed later in this paper in a more generic sense with regard to the distinction between a construct and a particular measure of that construct.

Learning distinguished from instruction. As Smith (1961, p. 88) pointed out, learning is distinct from instruction, learning often occurring either without instruction or in spite of instruction. The former case is indicated in Figure 1 by "non-instructional experiences"; the latter case is indicated by "achieved unintended learning outcomes," occurring either as a concomitant result of instruction or from non-instructional experiences.

Multiple Outcomes of Instruction

Psychologists and educationists have pointed out that anticipated learning outcomes are often accompanied by unanticipated results (Figure 1). Cronbach (1964) argued for the consideration of multiple learning outcomes,

whether one is involved in evaluation of courses for their improvement, curriculum theory building, or practical research for decision-making purposes. Regardless of the purpose, a thorough description of the effects of a particular course of study requires a differential investigation of many possible outcomes, since the effects of instruction are multidimensional and must, therefore, be mapped out separately (Cronbach, 1964, p. 235-236).

Not all outcomes of instruction are desirable and a thorough description of a course must include both desirable and undesirable outcomes in both the affective and cognitive domains of learning (Tyler, 1950, p. 40-41). For example, interest, appreciation, and enjoyment, as well as the lack thereof, are all possible outcomes of instruction which should be assessed when describing the effects of a course. Lumsdaine (1963) stressed the danger of forming conclusions from experimental findings based on arbitrary criterion variables. He advocated investigations based on "several independent indicators" (1963, p. 661). His points are consistent with Cronbach's and Tyler's concern about the generalizability of findings based on single measures of the effects of instruction.

Furthermore, curricular and instructional research, dealing with multiple learning outcomes, would aid in the selection of instructional treatments that produce a variety of desirable outcomes. As a consequence, instructional technologists would be able to group various objectives within the same learning experience (Tyler, 1950), thereby contributing to a more parsimonious program.

Lastly, when alternative courses in a particular area are being compared, it might be desirable to find out how well the graduate of one course can understand issues in another, i.e., how much overlap of learning outcomes exists (Cronbach, 1964, p. 244). Without this information proper decision-making is difficult.

Thus, research investigating multiple outcomes of instruction could aid in the answering of several questions: (a) What are the achieved learning outcomes of a particular combination of a curriculum and an instructional treatment? (b) How do different combinations compare in their effect on both a particular outcome and also across various outcomes? (c) Does a particular combination of a curriculum and an instructional treatment discriminate between two or more outcomes? If all the outcomes considered are desirable, then discrimination between the outcomes, whether they be intended or unintended, is neither necessary nor desirable. If, however, some outcomes are desirable and some are not desirable, then discrimination is necessary.

Research into the relative effectiveness of curriculum and instruction in the differential achievement of intended and unintentional outcomes is certainly not new. For several years researchers in psychology have been interested in the relative effectiveness of various independent variables on intentional versus unintentional or "incidental" learning. Using incidental versus intentional learning as the dependent variable, many independent variables, both curricular and instructional in nature, have been investigated, such as syntactical versus unsyntactical material (Epstein and Arlinsky, 1965); time (Bahrick, 1957; Miller and Lasko, 1964);

contingent reinforcement (Dixon and Moulton, 1967); rate of presentation and instructions given (Dornbush and Winnick, 1967); and amount of induced attention (Schneider and Kintz, 1967). Although not unanimous, most of these researchers report differential achievement of incidental compared with intentional learning outcomes as a result of varying different curricular or instructional variables.

Constructs and Construct Validity

Researchers in curriculum and instruction continually deal with constructs embodied by each of the previously discussed educational components. The following sections are concerned with the nature of constructs, general types of validation, and the importance of one of these types, namely, construct validity. Construct validity is then explicated in the context of one educational component, i.e., the achieved learning outcomes. Finally, suggestions are given for the investigation of construct validity for other educational components.

Constructs

The term "construct" has been used in various ways by various writers. For the purpose of this paper construct is defined as any postulated attribute of people or of situations assumed to be reflected in some objective indicator. This definition, although more general, is consistent with Cronbach and Meehl's definition. They defined a construct as "some postulated attribute of people assumed to be reflected in test performance" (1955, p. 283). The proposed definition is also consistent with Kantor's description of constructs "as products derived from [observers] interbehaving with events" (1963, p. 181) and Margenau's (1950)

description of constructs as concepts derived from a combination of sensory perception (e.g. objective measures) and rational creative processes (e.g. postulation). Thus, constructs are distinguished from "the events or stimulus objects in connection with which they are engendered" (Kantor, 1963, p. 181). This distinction is analogous to the previously discussed distinction between learning and measures of learning.

Types of Validation

There are four types of test validation (Cronbach and Meehl, 1955). Predictive validity is the extent to which a test score predicts status of subjects with respect to some criterion in which one is interested. Concurrent validity is the extent to which a test can be considered a substitute for another test of the same construct. Content validity is achieved when a test consists of a set of items that an investigator deductively determines to be a representative sample of a universe in which he is interested. If a measure is considered to consist of a construct component combined with an assessment method component, i.e., a [construct - assessment method] unit, then construct validity is concerned with the proportion of the variance associated with test scores that can be attributed to the construct itself, rather than to the assessment method.

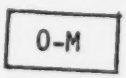
Construct Validity

Whereas predictive, concurrent, and content validity are all important for decisions regarding the use of tests in practical testing situations, construct validity is of primary significance in basic theoretical research. Determination of construct validity addresses the problem of separating the variance attributable to the construct from that

attributable to the assessment method. In order to accomplish this sort of separation, the same construct must be assessed by two or more divergent methods (Cronbach and Meehl, 1955; Campbell and Fiske, 1959; Webb et al, 1966; Garner, 1954; Garner, Hake, and Eriksen, 1956). Once these independent assessments have been obtained they can be compared; if the tests are purported to assess the same construct, then test scroes should correlate highly (Cronbach and Meehl, 1950; Campbell and Fiske, 1959). Campbell and Fiske (1959) suggested that tests representing a common assessment technique but different constructs also be compared. Correlations between measures of supposedly different constructs should be low even when the assessment method is the same. This latter aspect of construct validity, Campbell and Fiske (1959) termed "discriminant validity"; the correlation between different measures of the same construct they termed "convergent validity." Several writers have suggested matrices of intercorrelations for assessing the various aspects of construct validity (Cronbach and Meehl, 1955; Campbell and Fiske, 1959).

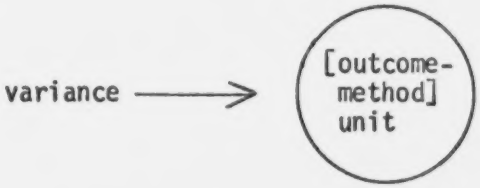
Achieved Learning Outcomes as Constructs

Achieved learning outcomes may be viewed as a class of constructs and, therefore, when assessing them, the construct validity of their measures must be considered. To determine construct validity a "multi-outcome multi-method" approach is needed in which any measure of an outcome is viewed as an [outcome - method] unit:

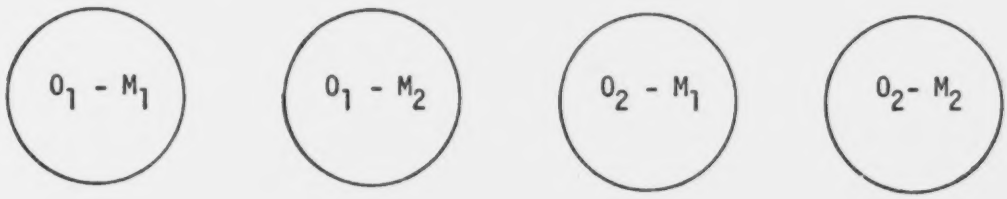


One task of the researcher is to differentiate between the achieved learning outcomes and their methods of assessment. The

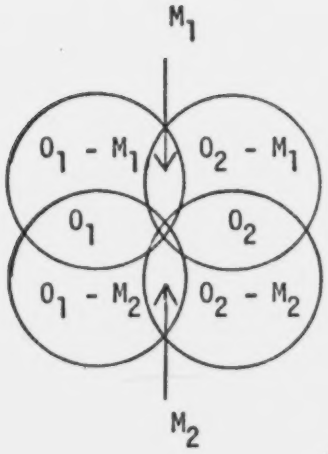
differentiation task may be visualized by considering the variance associated with an outcome assessed by a particular method as a Euler circle.



Assume, for example, that one is studying any two achieved learning outcomes, O_1 and O_2, e.g., spelling ability and vocabulary knowledge. Assume also that one has two methods for assessing each outcome, M_1 and M_2, e.g., multiple-choice and completion tests. The result is four [outcome-method] units, which are called outcome measures (Cronbach and Meehl, 1955). Assume further that each outcome measure ([outcome-method of assessment] unit) has a hypothetical variance of <u>one</u>, represented as follows.



Intercorrelating these four [outcome-method] units yields the following relationships:



The overlapping areas represent variance that is shared. It is probable that most of the variance shared by $O_1 - M_1$ and $O_2 - M_1$ will be shared method variance associated with M_1; likewise, $O_1 - M_2$ and $O_2 - M_2$ will share method variance associated with M_2. It also follows that most of the variance shared by $O_1 - M_1$ and $O_1 - M_2$ will be due primarily to "outcome variance" associated with O_1. Similarly, $O_2 - M_1$ and $O_2 - M_2$ will share "outcome variance" associated with O_2. Of course, if the two methods are not very divergent, e.g., alternate forms of the same test, then M_1 and M_2 will share a substantial amount of variance. It is therefore desirable to select methods of assessment that are maximally divergent.

If the achievement of a particular learning outcome by a group of subjects (Ss) is assessed by different methods, the results can be considered to consist of part "outcome variance" and part "method variance." Measures of purportedly similar achieved learning outcomes should share a substantial amount of variance regardless of the assessment method used; that is, they should possess convergent validity.

Information about the discriminant validity of outcome measures is also useful. That is, do purportedly different learning outcomes, even when assessed by similar methods, possess considerable common variance? Empirical differences are not necessarily expected even when obviously different outcomes are compared. For example, individuals who score highest on a measure of achievement might also score highest on an interest measure. Or, individuals who score highest on an arithmetic measure might also score highest on a reading measure. Yet even though the scores on these outcomes might correlate highly, the measures represent obviously different outcomes. Whether they are different or similar, however, the degree of correlation is important information for the researcher, as it reveals much about the extent to which different individuals achieve different outcomes. The empirical construct validity of outcome measures can be determined by the development and use of correlational matrices similar to those of Campbell and Fiske (1959) (See Figure 2).

		O_1		O_2	
		M_1	M_2	M_1	M_2
O_1	M_1	r_1			
	M_2	r_2	r_5		
O_2	M_1	r_3	r_6	r_8	
	M_2	r_4	r_7	r_9	r_{10}

Figure 2. A generalized paradigm of a simple correlation matrix useful for construct validation of measures of outcomes, O_1 and O_2, as assessed by methods, M_1 and M_2. Correlations r_1, r_5, r_8 and r_{10} are reliability cells; r_2 and r_9 are convergent validity cells; r_3 and r_7 are discriminant validity cells; r_4 and r_6 are hetero-outcome hetero-method cells.

Thus, the concept of multiple methods of assessment is relevant to the components identified earlier as being critical in education, i.e., curriculum, instruction and the achieved learning outcomes. When the purpose of a study is to determine whether or not significant differential effects result from two or more instructional treatments, the issue of construct validity raises the following questions: (a) Do the tests of the achieved learning outcomes possess discriminant validity? This aspect of construct validity would be demonstrated, if the correlation between scores on tests of purportedly different achieved learning outcomes is low even when the tests reflect similar approaches (methods) to assessment; (b) Do the tests of the achieved learning outcomes possess convergent validity? This aspect of construct validity would be demonstrated if scores on different tests of the same achieved learning outcome prove to be highly correlated.

In addition to the three components of education discussed earlier (curriculum, instruction, and achieved learning outcome), the method of assessing the achieved learning outcomes needs to be included in research designs. By providing for multiple methods of assessment, such designs would address the inherent construct validity problem when dealing with objective indicators of outcomes.

Other educational components as constructs. The concept of construct validity has been applied thus far to only one component of education, namely, the achieved learning outcomes. According to the definition of a construct given previously, however, the achieved learning outcomes are not the only component that can be considered a construct.

Instructional treatments, for example, are often postulated attributes of individuals or situations assumed to be reflected in objective indicators (e.g., amount of "structure" or "classroom climate"). When instructional treatments constitute a class of constructs, it is appropriate to investigate the construct validity of instructional treatment measures. This investigation requires that each of several instructional treatments be assessed by multiple methods in the context of one or more curricula. Instead of research designs consisting of four components (curriculum, instruction, outcomes, and methods of assessing outcomes), one involving three components (curriculum, instruction and methods of assessing instruction) is possible. The method of assessment component in the latter case relates to the instructional treatments rather than to the learning outcomes.

For example, two instructional treatments (direct and indirect teaching) can each be used in the context of two curricula (reading and arithmetic). Each of the instructional treatments can be assessed by two methods (such as Flanders' observational schedules and checklists filled out by students). Here the dependent variables are instructional treatment measures and the Ss are teachers. This type of research would yield information regarding (a) the differential effect of the reading versus the arithmetic curriculum on the teaching behavior of different teachers, (b) the discriminant validity of instructional treatment measures, and (c) the convergent validity of the instructional treatment measures.

The curriculum, too, may be considered a class of constructs, assuming that there are objective indicators of particular curricula. If these indices of curricula can be developed, their construct validity (both convergent and discriminant) can be examined. The dependent variable

in this case would be measures of curricula and instead of administering the measures to Ss, they would be applied to curricula being used in classrooms. This kind of analysis would result in information about the extent to which purportedly different curricula are empirically differentiated. By including in the study an element of education antecedent to curriculum (e.g., educational goals of a community or institution) the effects of these antecedent elements on the curriculum could be empirically investigated as well as the interaction between these elements and the curriculum.

An analysis of the seventeen aspects of specialization in "the curriculum-instruction field" identified by Johnson (1971), suggests other possible classes of educational constructs. Research into each aspect discussed by Johnson consists of studying the effects of certain independent variables on certain dependent variables. Presumably the administration of some measure ([construct-method of assessment] unit) to some group of "subjects" enables the researcher to study these variables empirically. The "subjects" vary in nature depending on the aspect and dependent variable being researched.

It is evident from an analysis of Johnson's dependent variables that the "subjects" appropriate for study include not only pupils, as in the designs suggested previously, but also, (a) other individuals such as teachers, curriculum developers, instructional supervisors, and evaluators of curriculum, instruction and instructional plans, and (b) products such as curricula, instructional plans, and evaluation reports; and (c) processes such as curriculum development deliberations, instructional processes and evaluation procedures.

In terms of construct validity of measures, the following questions can be raised: Are the measures of the variables associated with each of these seventeen aspects valid? That is, do they assess what they purport to assess? Do variables that are purportedly different (e.g., supervisor's "receptivity to change" and supervisor's "awareness of available materials and procedures") correlate poorly even when assessed by a common method (e.g., supervisor's self-report)? That is, do the measures possess discriminant validity? Do measures of a particular variable (e.g., supervisor's "receptivity to change") correlate highly even when assessment is by divergent methods (e.g., supervisor's self-report and teacher-report of supervisor's behavior)?

These questions of discriminant and convergent validity can also be raised when the "subjects" under study are not individuals but products or processes. Do measures of purportedly different variables (e.g., "validity" and "display/control feasibility" of instrumental content in an instructional plan) correlate poorly even when assessment is by the same method (e.g., consensus by a panel of "experts")? That is, do the measures possess discriminant validity? Similarly, do measures of a particular variable (e.g., validity of instrumental content in an instructional plan) correlate highly even when assessment is by divergent methods (e.g., consensus by a panel of "experts" and consensus by a panel of pupils)? That is, do the measures possess convergent validity?

Regardless of which aspect of education is under investigation, empirical research is facilitated by the use of valid objective indicators of the relevant constructs. One way to promote the use of valid measures

is for educationists to make a practice of operationally defining the constructs in at least two ways. This practice would facilitate construct validity procedures by providing for multiple methods of assessment.

In summary, then, educational components have been found in need of clarification for the purpose of theory-building in curriculum and instruction. Once clarified, empirical research can lead to a theoretical framework identifying the relationships between the various constructs embodied by each of the components. One problem in studying these constructs empirically has been identified and discussed, namely, construct validity. The use of multiple methods of assessment has been suggested as a means for addressing this problem.

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